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SPECIFICATION COVER SHEET

Client: Gowanus Canal Remedial Design Group **Project:** Gowanus Canal – 4th St Turning Basin Pilot Study – Dredging and Capping **Project #:** HPH106A

SPECIFICATION SECTION: 35 43 00 **TITLE:** CAP CONSTRUCTION

SPECIFICATION PREPARED BY:
(Specification Preparer, SP)
Signature _____ Name Dogus Meric Date 5/18/2017

SCOPE AND FORMAT CHECKED BY:
(Scope and Format Checker, SFC)
Signature _____ Name Jennifer Wilkie Date 5/19/2017

DETAILED REQUIREMENTS CHECKED BY:
(Detailed Requirements Checker, DRC)
Signature _____ Name Darrell Nicholas Date 5/19/17

APPROVED BY:
(Specification Approver, SA)
Signature _____ Name J.F. Beech Date 19 MAY 2017

Record of Revision (Number and initial all revisions)

Rev. No.	Reason	Date	By	Checked	Approval
0	TB4 Pilot Study Design – Issued for Bid	05/19/17	DM	JW	JFB

SECTION 35 43 00

CAP CONSTRUCTION

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SECTION 35 43 00

CAP CONSTRUCTION

PART 1 GENERAL

1.01 SUMMARY

A. A cap shall be installed in the 4th Street Turning Basin as shown on the Construction Drawings and as specified herein. The cap is to be installed after dredging and preparation for the capping surface is complete according to Section 35 20 23.13 the Construction Drawings.

B. Sand backfill will be placed along the western limit of the 4th Street Turning Basin Pilot Study Area and under the 3rd Avenue Bridge as presented on the Construction Drawings. A sand leveling layer shall be placed after dredging and backfilling to prepare the surface for capping.

C. The cap shall consist of three primary layers as follows from the base layer to the surface: (i) an adsorptive Treatment Layer designed to sequester contaminants; (ii) a sand isolation and filter layer; and (iii) an armor layer (see Drawings). The isolation and filter layer, along with material integrated into the armor layer, will also serve as an ecological habitat layer. A structural concrete for underwater applications will be placed between the armor layer and the bulkheads.

D. The Contractor shall furnish all labor, materials, tools, and equipment necessary for completion of this Work.

1.02 RELATED SECTIONS, PLANS, AND DOCUMENTS

A. Section 01 33 00 Submittals

B. Section 01 35 29 Health, Safety, and Emergency Response Requirements

C. Section 01 60 00 Product Requirements

D. Section 01 71 23 Site Surveying and Grade Control

E. Section 02 60 16 Sediment and Floatables Containment

F. Section 35 20 23.13 Dredging and Dewatering

G. Contract Documents

1.03 REFERENCES

A. ASTM International (ASTM) Standards:

1. ASTM C136 Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates;
2. ASTM D422-63 Standard Test Method for Particle-Size Analysis of Soils;
3. ASTM D854 Standard Test Method for Specific Gravity of Soil Solids;
4. ASTM D2216 Standard Test Method for Determination of Water (Moisture) Content of Soil and Rock by Mass;
5. ASTM D2434 (Modified) Standard Test Method for Permeability of Granular Soils (Constant Head);
6. ASTM D3860 Standard Practice for Determination of Adsorptive Capacity of Activated Carbon by Aqueous Phase Isotherm Technique;
7. ASTM D5029 Standard Test Method for Water Solubles in Activated Carbon;
8. ASTM D6684 Standard Specification for Materials and Manufacture of Articulating Concrete Block Revetment Systems;
9. ASTM D6884 Standard Practice for Installation of Articulating Concrete Block Revetment Systems;
10. ASTM D7276 Standard Guide for Analysis and Interpretation of Test Data for Articulating Concrete Block (ACB) Revetment Systems in Open Channel Flow;
11. ASTM D7277 Standard Guide for Performance Testing of Articulating Concrete Block (ACB) Revetnment Systems for Hydraulic Stability in Open Channel Flow;
12. ASTM D7481 Standard Test Methods for Determining Loose and Tapped Bulk Densities of Powders using a Graduated Cylinder; and
13. ASTM D7626 Standard Test Methods for Determining the Organic Treat Loading of Organophilic Clay.

B. American Association of State Highway and Transportation Officials (AASHTO):

1. AASHTO T-85 Specific Gravity and Absorption of Coarse Aggregate.

C. CETCO:

1. CETCO Test Method for determining oil adsorption capacity of oleophilic clay.

D. Environmental Protection Agency (EPA):

1. EPA SW-846 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods.

E. New York State Department of Environmental Conservation (NYSDEC):

1. NYSDEC Environmental Remediation Programs of December 14, 2006 Part 375 – 6 Remedial Program Soil Cleanup Objectives.

F. New York State Department of Transportation (NYSDOT):

1. *Standard Specifications*, Construction and Materials (USC), latest version.

1.04 DEFINITIONS

A. Armor Layer – Layer overlying the filter and isolation layer designed to protect the other cap layers by withstanding erosional forces in the Canal. The armor layer will be comprised of open-cell articulated concrete blocks (ACBs).

B. Backfill for the 3rd Avenue Bridge – Backfill placed after Phase III Dredging for locations beneath the 3rd Avenue Bridge (i.e., areas east of the TB4 Pilot Study Area).

C. Backfill for the Western Limits of the Cap – Backfill placed at the western limits of the TB4 Pilot Study Area from the toe of the 3H:1V slope to a location 25 feet east (i.e., limits of active cap).

D. Demonstration Area – a 50-ft wide section of the Canal where the Treatment Layer will be installed to test the placement method prior to capping the remainder of TB4.

E. Ecological Habitat Layer – The ecological habitat layer is comprised of both the gravel placed within the voids of the ACB mats used in the armor layer and the sand that constitutes the isolation and filter layer.

F. Structural Concrete for Underwater - Structural concrete placed underwater to be located between the edge of ACB mats and the bulkheads.

G. Granular Activated Carbon (GAC) – Processed carbon with micropores and high sorbent surface area intended to sorb dissolved phase contaminants.

H. GAC+sand – The portion of the Treatment Layer comprised of GAC mixed with sand.

I. Isolation and Filter Layer – Clean sand layer that will be placed above the Treatment Layer to serve as the base for the armoring layer.

J. Oleophilic clay (OC) – Clay mineral treated with a quaternary amine resulting in an oleophilic material.

K. OC+sand – The portion of Treatment Layer comprised of OC mixed with sand.

L. Phase I Dredging – Dredging of Soft Sediment.

M. Phase II Dredging – Dredging of Targeted Native Alluvial Removal Areas (TNARA).

N. Phase III Dredging – Dredging of Sediments beneath the 3rd Avenue Bridge.

O. Reactive Material – Adsorptive material that can adsorb and sequester contaminants, such as oleophilic clay and GAC.

P. Leveling Layer – Layer of clean sand placed to provide a level base. The material will be placed on top of: (i) the dredged sediment surface in Phase I dredging areas after post-dredging backfill placement and (ii) in areas of Phase II Dredging after the post-dredging backfill has been placed.

Q. Survey - Marine surveys of the capping area shall be hydrographic surveys in accordance with the USACE Hydrographic Surveying Manual and Section 01 71 23.

R. Treatment Layer – Two distinct adsorptive treatment layers: (i) lower layer comprising OC+sand and (ii) upper layer comprising GAC+sand.

1.05 SUBMITTALS

A. The Contractor shall submit the following to the Owner's Representative in accordance with Section 01 33 00:

1. Cap Construction Work Plan:

a. The Contractor shall identify proposed material sources and submit supplier information along with material characterization reports. The Contractor shall verify that materials are available in sufficient quantities to complete the Work;

b. Vendor product data and technical specifications for the selected ACB mat shall be provided including summary of recommended critical shear stresses and velocities for the mat, testing and analysis per ASTM D7277 and D7276, results of ASTM D7276 regression analysis, and appropriate design details including weight, percentage of open areas, and sizes;

c. The Contractor shall describe the means, methods, and verification procedures to place ACB mats to be within the design tolerances for spacing between individual mats and for spacing near bulkhead edges;

d. The Contractor shall describe the means, methods, and verification procedures to place gravel within the voids and gaps of the ACB mats to the specified design tolerances.

e. The Contractor shall describe how the Class G structural concrete for underwater applications will be placed in accordance with New York State Department of Transportation (NYSDOT) Specification 555-3.05 including the source of concrete and equipment necessary for installation. The Contractor shall describe the means and methods for verification of placement within the design tolerances specified in this Section and in the Construction Drawings;

f. The Contractor shall describe field procedures for mixing reactive material batches to achieve reactive material batch mass per unit volumes and pre-installation homogeneity as specified in this Section and in the Construction Drawings;

g. The Contractor shall describe the location of a fifty (50) lineal foot long demonstration area across the full width of the canal to evaluate the pre-installation and post-installation QC requirements as specified in this Section. The Contractor shall propose the timing of the demonstration application with the final schedule to be agreed upon with the Owner's Representative;

h. The Contractor shall describe placement methods and equipment and provide expected production rates (area per unit time) for each capping layer;

i. The Contractor shall describe the sequence of placement for each capping layer and coordination with dredging and other project components;

j. The Contractor shall describe placement sequence and means and methods to limit disturbance (i.e., movement, erosion, and suspension) of capping layers and sediment during and after placement of individual layers;

k. The Contractor shall describe the means and methods of preventing cross-contamination of cap materials during adjacent construction;

l. The Contractor shall describe means and methods for measuring progress and verifying areal coverage and thickness of each capping layer; and

m. The Contractor shall maintain cap material stockpile areas in accordance with Section 01 55 29.

2. Reactive Material Certification for each manufacturer or supplier as follows:

a. The Contractor shall provide a supplier quality assurance (QA)/QC certificate for OC and GAC, including certification of virgin material;

b. The Contractor shall request instructions on handling and storage for OC and GAC from the manufacturer or supplier; and

c. The Contractor shall provide product data to demonstrate compliance with requirements specified herein including physical and chemical characteristics of the OC and GAC.

3. Sand Material Characterization Reports:

   a. Test reports shall be provided by a laboratory independent of the material supplier.

4. Grain Size Distribution Results Reports for sand and gravel.

5. Weekly and daily progress reports in accordance with Section 01 32 00.

6. Available QC data including:

   a. Reactive material pre-installation QC field test results as specified in this Section;

   b. Thickness verification report for all cap layers with the exception of the structural concrete to be placed underwater and gravel placed within the voids of the ACB mats;

   c. Reactive material post-installation *in situ* QC testing results as specified in this Section; and

7. The following QC data for the ACB mats:

   a. Test data showing the concrete products were manufactured within 24 months prior to anticipated placement date per ASTM D6684; and

   b. Compressive strength, water absorption, and unit weight (density) sampling methodologies, and results in accordance with ASTM D6684.

   c. Vendor product data and technical specifications for the selected ACB mat shall be provided including summary of recommended critical shear stresses and velocities for the mat, testing and analysis per ASTM D7277 and D7276, results of ASTM D7276 regression analysis, and appropriate design details including weight, percentage of open areas, and sizes;

8. The Contractor shall provide a report from the concrete supplier verifying the structural concrete for underwater applications is Class G in accordance with NYSDOT specifications.

9. Surveys

    a. Required hydrographic capping surveys include after placement of the: (i) leveling layer; (ii) combined OC + sand component of the Treatment Layer (first Treatment Layer survey); (iii) combined GAC and sand (second Treatment Layer survey); (iv) isolation and filter layer; and (v) placement of the ACB mats and sand backfill at western limits of the cap (i.e., the final cap survey).

    b. Required submittals for the surveys include:

        i. Sorted minimum sounding data in XYZ format;

        ii. Sorted average sounding data in XYZ format; and

        iii. A bathymetry map depicting 0.5-foot contours within the 4th Street Turning Basin with minimum soundings from each grid cell (soundings below grade shall be in one color, while soundings above grade shall be another)

10. Calculations

    a. Calculations for total volume of the two treatment layer and leveling layer placed;

    b. Calculations for the combined area of ACB mat placed;

    c. Calculations based on delivered and placed structural concrete for under water applications;

    d. Calculations based on delivered and installed material for the volume of gravel placed within the voids of the ACB mats; and

    e. Calculations for the volume of sand backfill placed at the western limits of the TB4 Pilot Study Area.

1.06 HEALTH AND SAFETY REQUIREMENTS

A. The Contractor shall comply with environmental health and safety/training requirements in accordance with the approved Health and Safety Plan and Section 01 35 29.

PART 2 PRODUCTS

2.01 SAND

A. Sand used for the following purposes shall meet the requirements of NYSDOT 733-15 for source, gradation, durability, and pH:

1. Base leveling layer;

2. Sand portion of the Treatment Layer;

3. Isolation and a filter layer;

4. Backfill placed within the western limits of TB4 (as presented on the Construction Drawings); and

5. Backfill placed under the 3rd Avenue Bridge.

B. Gravel placed within the ACB mats:

1. The Contractor shall furnish material consisting of crushed stone or gravel, free of soft, non-durable particles, organic material and thin or elongated particles having a gradation for AASHTO #67 as presented in Table 1 below.

Table 1. Gradation for Gravel Placed within the ACB Mats

Sieve Size	Percentage Passing by Weight
1 inch	100
3/4 inch	90-100
3/8 inch	20-55
No. 4	0-10
No. 8	0-5

2.02 REACTIVE MATERIAL

A. Oleophilic Clay

1. The adsorptive layer shall consist of virgin CETCO Organoclay® PM-199, PM-200, or OC with equivalent or greater NAPL sorption capacity and equivalent permeability to these products.

2. OC shall be suitably packaged to isolate the material from the environment to preserve its efficacy, and to avoid loss of material in transit and/or for the duration of storage. Prior to shipment, Vendor shall label each package with the following information:

    a. Manufacturer name;

    b. Manufacturer address;

    c. Product code and lot number; and

    d. Certification documentation.

B. Granular Activated Carbon

1. The GAC+sand Treatment Layer shall consist of virgin Calgon Carbon Filtrsorb®400 GAC.

2. GAC shall be suitably packaged by the Vendor to isolate the material from the environment in order to preserve its efficacy for the duration of shipment and storage. Prior to shipment, Vendor shall label each package with the following information:

    a. Manufacturer name;

    b. Manufacturer address;

    c. Product code and lot number; and

    d. Certification documentation.

2.03 ARMOR LAYER

A. The ACB mats, constituting the armor layer, are designed to protect the Treatment Layer from erosional forces associated with hydrodynamic forces and vessel traffic. The required properties of the armoring material are summarized as follows:

1. The armoring material shall consist of ACB mats; where ACB mats are considered a matrix of interconnected concrete block units connected by geometric interlock and/or cables;

2. The ACB mats shall have a thickness of 6 inches plus or minus 0.5 inches;

3. The cementitious materials of the ACB mats shall conform to ASTM D6684;

4. The aggregates shall conform ASTM D6684;

5. Revetment cables and fittings shall be designed in accordance with ASTM D6684 and provide a minimum factor of safety of 5.0 for lifting and handling. Physical requirements for ACB mats shall conform to Table 1 from ASTM D6664;

6. The minimum critical shear stress and critical velocity based on full-scale laboratory testing and recommended by the manufacturer shall be at least 8 pounds per square foot (psf) and 14 feet per second (fps), respectively, on both a flat slope and on a three horizontal to one vertical slope (3H:1V). The test and analysis of the values shall be in accordance with ASTM D7277 and ASTM D7276.

7. The percent of open area of the ACB mat shall be between 15 and 25 percent;

8. The maximum spacing between individual ACB mats shall be two inches; and

9. The spacing from the outside edge of ACB mats to the outside edge of bulkheads and to the limits of dredging shall be one to two feet. In confined locations, the Contractor may request a greater allowance. The request shall be written and provided to the Owner's Representative five business days prior to placement.

2.04 STRUCTURAL CONCRETE FOR UNDERWATER

A. The structural concrete for underwater applications shall consist of NYSDOT Class G Concrete. The concrete shall not contain fly ash. The structural concrete shall have a thickness of 6 inches plus or minus 2 inches and generally be flush with the top of the ACB mats.

PART 3 EXECUTION

3.01 GENERAL

A. Maintain stockpile areas free of water, debris, and foreign material during storage, handling, and placement of materials. Provide stormwater protection of stockpiled material in accordance with the best management practices described in the approved Cap Construction Work Plan.

B. An appropriate mixing method, using equipment designed for material blending, shall be used to achieve a uniform thickness and mix of reactive material with sand. Mixing with excavation equipment, specifically an excavator bucket, will not be permitted.

C. The Contractor shall control sediment and floatables in accordance with Section 02 60 16 as needed during capping operations (e.g., to prevent cap recontamination in the event of a storm).

D. Perform installation of each Treatment Layer in accordance with the approved Cap Construction Work Plan within the approved demonstration area to evaluate and identify the effective placement methods.

E. Perform installation of each cap layer in accordance with the approved Cap Construction Work Plan.

F. Cap layer installation for the 4th Street Turning Basin and under the 3rd Avenue Bridge will start only after dredging activities have been completed in the 4th Street Turning Basin and under the 3rd Avenue Bridge, respectively in accordance with Section 35 20 23.13. The Contractor shall sequence the dredging activities and placement of cap layers to minimize cross-contamination, limit project disruptions, and preserve the project schedule.

G. The GAC+sand Treatment Layer shall be pre-wetted prior to placement to minimize loss of carbon.

H. Cap Treatment Layer shall be placed in a manner that minimizes the separation of reactive material from the sand.

I. Cap layers shall be placed in a manner which minimizes resuspension of sediment and mixing of sediment with capping materials.

J. Cap layers shall be placed in a manner which minimizes disturbance of and mixing with previously placed cap materials.

K. Materials shall be placed according to the dimensions specified in the Construction Drawings and as follows:

1. The horizontal tolerance for placement for the leveling layer, treatment layers, and isolation and filter layer shall be plus or minus two feet from the western limit of the cap as presented on the Construction Drawings. The materials shall extend to the neatline to the north, south, and east of the TB4 Pilot Study Area.

2. The horizontal tolerance for placement of the armor layer and gravel placed within the voids of the ACB mats shall be: plus or minus two feet from the western limit of the cap; and (ii) within 1 to 2 feet from the front edge of the bulkheads as presented on the Construction Drawings.

3. The horizontal tolerance for the placement of the Cap Type 1 and Cap Type 2 shall be plus or minus two feet from the boundary presented on the Construction Drawings.

4. The vertical tolerance for the leveling layer shall be 6 inches plus or minus 3 inches.

5. OC content of the OC+sand layer shall be no less than 25% by dry weight based on the pre-installation QC criteria specified in this Section;

6. OC+sand layer thickness shall be a minimum of 6-inches and not to exceed 9-inches.

7. GAC content of the Cap Type 1 (see Construction Drawings), GAC+sand layer shall be no less than 5% by dry weight based on the pre- and post-installation QC criteria specified in this Section;

8. GAC content of the Cap Type 2 (see Construction Drawings), GAC+sand layer, shall, on average, be 40% GAC by dry weight with a minimum GAC content no less than 36% by dry weight based on the pre- and post-installation QC criteria specified in this Section;

9. GAC+sand layer shall be a minimum of 4-inches and not to exceed 7-inches.

10. The vertical tolerance for the isolation and filter layer shall be 6 inches plus or minus 2 inches.

11. Gravel placed within the voids of the ACB mats (armor layer) shall be flush with the top of ACB mats plus or minus 1 inch with a typical thickness of 6 inches.

12. Sand backfill placed within the western limits of the cap shall be to the elevation of the top of armor layer plus or minus 3 inches.

13. The Contractor shall complete corrective measures on any layer prior to placement of the next successive material; and

14. The Contractor will not be reimbursed for placement of materials beyond tolerances.

L. ACB mats shall provide close contact with the underlying isolation and filter layer and limit disturbance during placement in accordance with the manufacturers recommendations. Installation of the ACB mats shall be in accordance with the applicable requirements of ASTM D6884.

M. The Contractor shall tremie or pump the structural concrete for underwater placement in accordance with New York State Department of Transportation (NYSDOT) Specification 555-3.05(A) and 555-3.05(B)(1) or (2) including the source of concrete and equipment necessary for installation. The structural concrete shall be approximately level with the top of the ACB mats plus or minus two inches. Concrete shall only be placed in water when temperatures range from 32°F to 90°F.

3.02 INSPECTION AND TESTING OF CAP MATERIALS

A. Gravel

1. The Contractor shall conduct one representative grain size distribution analysis (ASTM D422-63) prior to delivery to the site. If multiple sources are used, the Contractor shall conduct a representative grain size distribution analysis (ASTM D422-63) for each source.

2. The Contractor shall inspect the gravel to confirm the material is free of soft, non-durable particles, organic material and thin or elongated particles

B. Sand

1. The Contractor shall inspect material at the Site prior to placement.

2. The Contractor shall visually inspect material for the presence of foreign, recycled, or reprocessed materials. The presence of such materials will be cause for rejection and return to the supplier.

3. The Contractor shall be responsible for maintaining gradations specified herein. Materials which do not meet gradation or quality criteria specified herein will be rejected and no payment will be made regardless of any general or provisional acceptance of materials from a stockpile or pit source.

4. The Contractor shall conduct a representative grain size distribution analysis (ASTM D422-63) prior to delivery for every 2,000 tons of sand delivered to the Site for placement. If multiple sources are used (e.g., if different sand is used for the isolation and filter layer versus leveling layer), the Contractor shall conduct a representative grain size distribution analysis (ASTM D422-63) for each source.

5. The Contractor shall perform chemical analyses of the representative sand material according to the requirements in 6 NYCRR 375-6. Analytical testing shall be conducted on a 5-point composite sample prior to delivery for every 5,000 tons of material delivered to the Site for placement. If multiple sources are used, the Contractor shall conduct analytical testing for each source. The analytical testing shall include:

    a. Priority Pollutant Metals (EPA 6000/7000 Series Methods);

    b. Volatile Organic Compounds (EPA Method 8260);

    c. Semivolatile Organic Compounds (EPA Method 8270);

    d. Chlorinated Pesticides (EPA Method 8081); and

e. Polychlorinated Biphenyls (EPA Method 8082).

f. Samples will be collected in accordance with the Contractor's Quality Assurance Project Plan (see Section 02 51 19).

6. If the testing results indicate that the material does not meet acceptance criteria based on 6 NYCRR 375-6, the Contractor shall identify another material source and proceed with material testing in a timely manner.

C. Oleophilic Clay

1. Contractor shall conduct a visual inspection of OC upon receipt to identify any damage to packaging. Contractor shall further inspect product received in damaged packaging to verify product integrity in accordance with Section 01 60 00.

2. Contractor shall provide appropriate protection of OC from weather and other environmental stressors until use (e.g., spills).

D. Granular Activated Carbon

1. Contractor shall conduct a visual inspection of GAC upon receipt to identify any damage to packaging in accordance with Section 01 60 00. Contractor shall further inspect product received in damaged packaging to verify product integrity.

2. Contractor shall provide appropriate protection of GAC from weather and other environmental stressors until use (e.g., spills).

E. Armor Layer

1. Contractor shall conduct a visual inspection of ACB mats upon receipt to identify any damage to the product prior to placement in accordance with Section 01 60 00.

2. Products with cracks exceeding 0.25 inches in width or 1.0 inches in depth shall be rejected.

3. Products which are chipped where chipping results in a loss exceeding 10% of the average weight of a concrete unit shall be rejected.

F. The Contractor shall verify the structural concrete is mixed adequately prior to placement and verify the correct volume of material was placed.

3.03 TREATMENT LAYER MIXING

A. The Contractor shall for the duration of the Treatment Layer construction:

1. For reactive materials mixed with sand, verify mix fractions by documenting weight of reactive material and sand in the mix for each batch of 100 tons.

2. The Contractor shall number each batch and calculate mix fractions of each batch to demonstrate that batches comply with the criteria specified herein.

3. The Contractor shall collect 3 grab samples from each batch and visually inspect and photo-document each batch for homogeneity of the reactive material and sand mixture.

4. For the mixing procedure to be accepted as set forth in Part 3.04 of this section, the calculated mix fraction of reactive material in each sample shall achieve the design criteria listed in the Contract Documents and this Section, and the uniformity of the reactive material shall be approved by the Owner's Representative.

5. The Contractor shall submit mixing documentations as part of the weekly reports.

3.04 TREATMENT LAYER PLACEMENT

A. *In Situ* Demonstration Testing.

1. Prior to implementation of the Cap Construction Plan, the method of Treatment Layer placement must be verified to ensure design specifications are met. The Treatment Layer will be installed on a 50-ft wide section of TB4 (the Demonstration Area) to test the Treatment Layer placement method:

   a. The Contractor shall propose a method to collect *in situ* samples, such as using box coring or catch pans, minimum 6 inch width and 12 inch depth, for both visual inspection and laboratory testing. The sampler shall be:

      - Placed on the OC+sand layer prior to GAC+sand material placement and removed after the GAC+sand layer is installed in the Demonstration Area; and

      - Constructed of clear material to permit visual observation of the GAC+sand layer.

   b. The Contractor shall collect 5 *in situ* samples of the GAC+sand layer within the Demonstration Area from random locations selected by the Owner's Representative.

   c. The samples will be used to (i) measure GAC+sand layer thickness and (ii) qualitatively (e.g., visually) evaluate the uniformity of the as-built mixing. The samples then will be homogenized and shipped to a third-party laboratory by the Owner's Representative for loss on ignition testing to determine as-built GAC content.

2. If test results indicate that the as-built GAC+sand layer thickness and composition do not meet the design specifications detailed herein, the Contractor

shall modify the installation method and perform an additional 50 foot wide Demonstration Area across the Canal, conducting *in situ* sampling requirements as specified above. The Contractor shall rework the areas represented by samples that are out of compliance by installing an additional thickness of GAC+sand layer materials to obtain the desired dosage on a pound per square foot of active ingredient basis at no additional cost. There will be no payment for stand-by time used while awaiting the results of testing for acceptance of demonstration areas or for rework of areas out of compliance.

3. When the results indicate that the as-built GAC+sand layer thickness and composition in the Demonstration Area meet the design specifications, the Contractor shall proceed with the installation method throughout the Turning Basin. No additional loss on ignition tests will be required.

B. Post-Installation *In Situ* Full Scale Implementation

1. Following full-scale installation of each Treatment Layer in the Turning Basin, the Contractor shall measure the thickness of each Treatment Layer by collecting samples on a triangular grid pattern (see Construction Drawings) using the method approved for collection of *in situ* samples from the Demonstration Area.

2. Before proceeding to the next layer, the Contractor shall correct any deficiency in thickness by adding additional Treatment Layer material to obtain the minimum thicknesses. The corrective measures shall be applied to the midpoint of a line between a failing sample location and the closest sampling point in compliance with thickness requirements.

3.05 SURVEYS AND VERIFICATION OF CAP PLACEMENT

A. Conduct a hydrographic survey of the leveling layer in accordance with Section 01 71 23. The Contractor shall conduct the leveling layer survey to confirm the leveling layer has been placed to the specified thicknesses and coverage areas as presented on the Construction Drawings and this Section.

B. The thickness of the Treatment Layers will be measured by collecting samples on triangular grid pattern (see Construction Drawings) using the method approved for collection of *in situ* samples from the Demonstration Area.

C. Conduct a hydrographic survey for the combined OC + sand component of the Treatment Layer (first Treatment Layer survey); and combined GAC and sand (second Treatment Layer survey). The Contractor shall conduct a Treatment Layer survey after each individual layer is installed to verify that the treatment components of the cap have been placed to the specified thicknesses and areas presented on the Construction Drawings and this Section. The average thickness of the Treatment Layer thicknesses will be based on the average thickness of the *in situ* samples. The confirmation of the area of coverage of the two treatment layers as presented on the Construction Drawings of the two treatment

layers will be based on their respective hydrographic surveys. The area of coverage for the OC+sand will be verified by comparing the first treatment layer survey with the leveling layer survey. The area of coverage for the GAC+sand will be verified by comparing the second treatment layer survey with the first treatment layer survey.

D. Conduct a hydrographic survey of the isolation and filter layer in accordance with Section 01 71 23. The Contractor shall conduct the isolation and filter layer survey to confirm the isolation and filter layer been placed to the specified thicknesses and coverage areas as presented on the Construction Drawings and this Section. The volume of the isolation and filter layer will be calculated by comparing the isolation and filter layer survey with the second treatment layer survey.

E. Conduct a hydrographic survey to confirm placement of the ACB mats and sand backfill at western limits of the cap, applications (i.e., the final cap survey).

1. The calculated area of coverage shall of the ACB mats shall be confirmed with the final cap survey. The Contractor shall also maintain documentation of where ACB mats were placed to confirm placement in the areas presented on the Construction Drawings. The total area of the ACB mats will be based on the total area of the ACB mats installed.

2. The calculated area of coverage and thickness of the sand backfill at western limits shall be confirmed with the final cap survey. The thickness of the sand backfill shall be calculated by comparing the after dredge survey and final cap survey. The document will be used to verify adequate placement and calculate volumes.

F. The ecological and habitat layer placed within the voids of the ACB mats shall be verified by the proposed means, methods, and verification procedures in the Cap Construction Work Plan.

G. Placement of the structural concrete for underwater applications shall be verified in these areas by probing as follows:

1. At every 5th notch in the sheet pile, the Contractor shall probe within the notch to determine the top elevation of the structural fill. If the structural concrete is more than two inch below the top of the ACB mats as indicated from the hydrographic survey, the Contractor shall place additional structural concrete underwater until the top of the structural fill is within two inches of the top of ACB mats for the closest three sheet pile notches on both sides (total of seven notches) of the measured sheet pile notch. Notes shall be maintained and submitted to the Owner's Representative which verify the probing has occurred and meets the tolerances required.

H. Verification that the sand backfill placed after Phase III Dredging shall be completed by probing on a 10' by 10' survey grid underneath the 3rd Avenue Bridge and will measure

the thickness of sand backfill. The probing will document placement volumes and area of coverage. Notes shall be submitted to the Owner's Representative verifying the probing has occurred.

3.06 PROTECTION, COMMUNICATION, AND CANAL AND SITE ACCESS

A. The Contractor shall conform to Protection, Communication, and Canal and Site Access requirements from Section 35 20 23.13.

[END OF SECTION]